

**Final Report**

**Yorkville / Glen Palmer Dam  
Alternative Analysis and Preliminary Design  
Project OWR-02-003**

# **YORKVILLE, ILLINOIS**



**Kendall County**

**December 2003**



**Illinois Department of Natural Resources  
Office of Water Resources  
One Natural Resources Way  
Springfield, Illinois 62702-1271**

# **TENG**

**205 North Michigan Avenue  
Chicago, Illinois 60601-5924**

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## SUMMARY

The Yorkville Police report that Glen Palmer Dam in Yorkville, IL, claimed 28 lives during the period from 1968 through 1993. Due to this safety problem, the Illinois Department of Natural Resources (IDNR) - Office of Water Resources (OWR) has undertaken various studies to look at alternative dam configurations to improve safety.

IDNR has established requirements for any dam on the Fox River which is owned or considered for ownership by IDNR. These requirements include: 1) public safety, 2) ecological improvement to the river, and 3) development of recreational opportunities. These requirements led to the creation of three specific criteria for the development of alternatives at the Glen Palmer Dam site in Yorkville:

1. Design of a safe spillway configuration
2. Design of a fish passage system
3. Design of a canoe passage system

This study is a result of IDNR contracting with Teng & Associates, Inc. to perform an alternative analysis and preliminary project design of either dam removal or a multi-purpose Yorkville Dam.

The project design team consisting of personnel from IDNR, Teng, Stantec, Cochran & Wilken, and Recreation Engineering and Planning worked with a Citizens Advisory Committee comprised of local area citizens and representatives of the City of Yorkville.

The mission of the design team was to work with a Citizens Advisory Committee

to develop potential project configurations, study at a conceptual level, and attempt to select a preferred project configuration, which would:

- utilize existing and past studies to the greatest extent possible,
- establish hydraulic conditions which minimize or eliminate the occurrence of a roller downstream of the dam,
- provide a facility that would allow canoeists to safely navigate a canoe through the dam site, and
- provide a design, which would prove attractive to fish movement in both the upstream and downstream directions.

The study included the following technical tasks:

- Hydrographic and land surveying of cross sections, approximately 500' downstream of the dam (DS), 100' DS, 100' upstream of the dam (US), 200' US, 500' US, and 1000' US to establish the state of sediment transport within the river and reservoir.
- Evaluation of fish passage and canoe bypass requirements to provide a design, which will prove attractive to fish movement in both the upstream and downstream directions while allowing canoe passage downstream.
- Development of design criteria for fish passage based on behavior and sensory modalities or avenues of sensation, including flows, vision, sound and olfaction of the species mix and the writing of a guidance memorandum for bypass channel layout.



- Development of design criteria for canoe bypass based on current state-of-the-art in recreational channel design.
  - Development of the following 6 alternative project layouts which included:
    1. Modifying the existing dam to eliminate the roller and adding short canoe and fish passage facilities on the left bank (looking downstream).
    2. Modifying the existing dam to eliminate the roller and adding long canoe and fish passage facilities on the left bank.
    3. Modifying the existing dam to eliminate the roller and adding canoe and fish passage facilities on the right bank.
    4. Modifying the existing dam to eliminate the roller and adding canoe and fish passage facilities to the center of the dam.
    5. Partial dam removal to facilitate construction of a river-wide rapid which maintains the existing headwater elevation.
    6. Complete dam removal.
  - Prioritizing and selecting alternatives for further study.
  - An environmental inventory and assessment of the alternatives to:
    1. Characterize the river discharge frequency.
    2. Evaluate changes to water surface profiles and velocities through the project reach in both the river and canoe and fish passage channel.
    3. Evaluate changes to water circulation patterns in the vicinity of the dam.
    4. Estimate changes in dissolved oxygen concentrations in the river and reservoir.
    5. Estimate changes in frazil ice production and the potential impact to water surface profiles.
    6. Determine cursory impacts to cultural resources, wetlands, and threatened and endangered species.
  - Preparation of Life cycle cost estimates for each alternative for a 50-year project life.
  - Selection of the best alternative for implementation with respect to evaluation criteria developed by the *Design Team* and Advisory Committee.
  - Preparing a complete project report.
- Past studies utilized in this study included the following references:
1. "Fox River Fish Passage Feasibility Study (Draft)", Max McGraw Wildlife Foundation, Santucci and Gephart, 2003.
  2. "Draft" "Yorkville Dam Evaluation, Special Project Study", IDNR, December 2000.
  3. "Hydraulic Model Study of a Canoe Chute for Low-Head Dams in Illinois", Caisley, Bonbardelli, and Garcia, University of Illinois, December 1999.
  4. "Canoe Chutes and Fishways for Low Head Dams: Literature Review and Design Guidelines", Caisley and Garcia, University of Illinois, January 1999.

5. "Hydraulic Model Study for the Drown Proofing of Yorkville Dam, Illinois", Freeman and Garcia, University of Illinois, May 1996.
6. "Considerations in Water Use Planning for the Fox River", by Singh, Butts, Knapp, Shackleford, and Larson, Illinois State Water Survey, September 1995.

The study was conducted by working with the Citizens Advisory Committee to identify project alternatives and to perform specific evaluation tasks which helped to screen some alternatives from further consideration. The two alternatives which survived this process to the end of the study were alternatives 2\* and 6. Alternative 2\* consists of modifying the existing dam to eliminate the roller, as in Alternative 2, and adding an intermediate length canoe and fish passage facilities on the left bank. Alternative 6 consists of dam removal and river restoration to the best estimate of pre-dam conditions.

For Alternative 2\*, the conclusions of Reference 5, where the University of Illinois Hydrosystems Laboratory looked at a number of alternative dam designs that would make the dam safer, were adopted as the correction for the dangerous hydraulic conditions. This consisted of modifying the existing overflow section to a four-step spillway as illustrated in Exhibit B-3. The bypass addition satisfied project fishery criteria and state-of-the-art canoe channel criteria specifically developed for the Yorkville project. This alternative accomplishes a "reconnection of the river", presently obstructed by the dam while preserving flat/deep water recreational benefits. The estimated

engineering and construction cost for alternative 2\* is approximately \$6,160,000, excluding project land rights cost. Land rights however are an issue only along the south bank adjacent to the 1000' length of the bypass.

Alternative 6, consisting of dam removal and river restoration. This alternative was purported by previous studies (references 1 and 2) to be the most effective way to address safety concerns, while offering significant economic and environmental benefits. Those studies included evaluation of the effects of the dam on both the physical and biological attributes of the Fox River. This study while agreeing with most previous study conclusions, found that the cost for implementing alternative 6 would be approximately 67% of that for alternative 2\*. Additionally the loss of reservoir depth water, while having positive environmental effects in hot low flow conditions, may have negative environmental effects during winter conditions, as the relatively deep water provides cover for fish. The estimated engineering and construction cost for implementing alternative 6 is approximately \$4,100,000, exclusive of project land rights costs. Land rights and associated cost may be an issue for approximately 16,000' of shoreline restoration.

Other conclusions of the study are as follows:

- A September 11, 2002 Hydrographic survey revealed the bottom topography to be similar to that of a previous survey in September 1999. The reservoir/river is in regime with sediment deposition occurring during low flow, and scour and transport



occurring during high flow. Contaminated bottom sediments are not an issue for any of the alternatives studied.

- Dissolved oxygen concentration is the only water quality parameter to differ significantly between the free flowing river and impounded sections. The difference is diurnal in nature and caused by algae photosynthesis and respiration. In free flowing river conditions flow induced turbulence allows rapid exchange of gases between water and the atmosphere. For reservoir conditions, absent wind generated waves, flow induced turbulence is not significant below a river discharge rate of 300cfs and the resulting slow exchange rate of gases between water and air do not keep up with the rates of photosynthesis and respiration.
- The river ice regime would change although not sufficiently to create any ice jam problems. Alternative 2\* would increase frazil ice production at the site by approximately 25%. Alternative 6 would reduce frazil ice production at the site by approximately 90%.

- The alternatives studied would likely not adversely affect cultural resources or threatened and endangered species.
- None of the alternatives would raise water surface elevations above current levels for any discharge rate. Wetlands would be unaffected by alternative 2\*. Alternative 6 would change approximately 46 acres of open water to wetland.

The City of Yorkville, through prior resolution, has strongly urged the IDNR "to preserve the existing Glen Palmer Dam in the United City of Yorkville, while making such enhancements that will protect persons from harm and create an ecologically safe passageway for fish and water craft to move both upstream and downstream of the of the dam without harm to the environment". As a result of this study, the local Citizens Advisory Committee, including the current mayor of Yorkville recommended the implementation of alternative 2\*. The design team prefers Alternative 6 but is sufficiently satisfied with the benefits of Alternative 2\* to recommend its implementation.